

CLAIMS

What is claimed is:

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1. A spatial light modulator comprising:
an array of pixels, each pixel including a solid state electro-optic material
positioned between a first electrode and a second electrode; and
an array of pixel circuits formed with a semiconductor substrate, each
pixel being connected to a pixel circuit.
 2. The modulator of Claim 1 wherein the solid state electro-optic material
comprises a ceramic material.
 3. The modulator of Claim 1 wherein the solid state electro-optic material
comprises PLZT.
 4. The modulator of Claim 1 wherein the pixel circuits comprise an array of
transistors formed on a silicon substrate.
 5. The modulator of Claim 1 wherein the electro-optic material comprises a thin
film layer having a thickness of 2000 nm or less.
 6. The modulator of Claim 1 wherein the electro-optic material comprises a
plurality of layers.
 7. The modulator of Claim 1 wherein each electrode comprises an electrically
conductive layer that contacts a dielectric layer.

8. The modulator of Claim 1 wherein the semiconductor substrate comprises a CMOS integrated circuit.

9. The modulator of Claim 1 further comprising a light source and an optical coupler.

5 10. The modulator of Claim 1 further comprising a memory circuit co-located with each pixel.

11. The modulator of Claim 1 wherein each pixel circuit comprises a random access memory.

10 12. The modulator of Claim 6 wherein a first electro-optic layer comprises a first electro-optic material and additional layers comprise a second electro-optic material.

13. The modulator of Claim 12 wherein the first layer comprises PZT.

14. The modulator of Claim 12 wherein the additional layers comprise PLZT.

15 15. The modulator of Claim 1 further comprising a first mirror underneath a first mirror underneath the electro-optic material and a second mirror above the electro-optic material.

16. The modulator of Claim 1 further comprising a first layer of dielectric material underneath the electro-optic material and a second layer of dielectric material above the electro-optic material.

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17. The modulator of Claim 16 wherein the first and second layers of dielectric material each comprise a stack of dielectric thin films.
18. The modulator of Claim 1 wherein the first and second electrodes comprise an optically transmissive conductive material.
19. The modulator of Claim 1 further comprising a copper interconnect extending from each pixel mesa along a mesa sidewall to a circuit contact of a pixel circuit.
20. A method of fabricating a spatial light modulator comprising:
 - providing a semiconductor substrate having a circuit;
 - forming a solid state electro-optic material on the semiconductor substrate;
 - forming an array of pixels with the electro-optic material; and
 - connecting the array of pixels to the circuit.
21. The method of Claim 20 further comprising forming a plurality of layers of electro-optic material to form an electro-optic thin film.
22. The method of Claim 21 wherein each layer is formed by depositing the electro-optic material and heating the material.
23. The method of Claim 20 further comprising forming a protective layer over the substrate circuit.
24. The method of Claim 20 wherein the forming step further comprises forming a thin film of PLZT.

25. The method of Claim 20 further comprising forming a first electrode and a second electrode that are connected to the circuit.
26. The method fo Claim 20 further comprising forming a CMOS circuit in a silicon substrate.
- 5 27. The method fo Claim 20 further comprising forming a first mirror under the electro-optic material and a second mirror over said material.
28. The method of Claim 20 further comprising forming metalization lines to interconnect the pixel array to the circuit.
29. The method of Claim 20 further comprising forming driver circuits and memory
10 circuits in the substrate.
30. The method of Claim 20 further comprising coupling the modulator to a light source and a detector array.
31. The method of Claim 20 further comprising forming a Fabry-Perot cavity with the electro-optic material.
- 15 32. The method of Claim 20 further comprising deopsiting the electro-optic material from the liquid phase.
33. The method of Claim 20 further comprsiing selecting proporations of a plurality of precursors to deposit the electro-optic material such that the mateiral is thermally matched to the substrate.

34. The method of Claim 20 further comprising forming a first dielectric stack under the electro-optic material and a second dielectric stack above the electro-optic material.
- 5 35. The method of Claim 20 further comprising providing a dip coating apparatus to deposit the electro-optic material from the liquid phase, said apparatus including a control system that controls movement of the substrate within a liquid solution and that heats a film deposited on the substrate.
36. The method of Claim 35 further comprising performing a sequence of deposition and heating steps to form a plurality of electro-optic layers.
- 10 37. The method of Claim 34 wherein each dielectric stack comprises alternating layers of high index of refraction material and low index of refraction material.
38. The method of Claim 20 further comprising forming a dielectric material, said material being an oxide selected from the group comprising SiO_2 , TiO_2 or Ta_2O_5 .
- 15 39. The method of Claim 20 further comprising forming an electro-optic layer having a thickness correlated to a wavelength of a light source that illuminates the modulator.
40. The method of Claim 20 further comprising forming an array having at least 640 by 480 pixels having a drive voltage of 5 volts or less.

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